Claims

We claim:

1. A method for animating a 3D physical object, comprising:

acquiring a 3D graphics model of the 3D physical object:

editing the 3D graphics model with graphics authoring tools to reflect a desired appearance of the 3D physical object;

rendering the virtual 3D graphics model as an image considering a user location and a location of a virtual light;

correcting intensity values of the image according to an orientation of a surface of the object and a radiance at the surface; and

illuminating the 3D physical object with the corrected image to give the 3D physical object the desired appearance under the virtual light when viewed from the user location.

2. The method of claim 1 further comprising:

scanning the 3D physical object with a 3D touch probe sensor to acquire the 3D graphics model.

3. The method of claim 1 further comprising:

storing the 3D graphics model in a computer memory as a triangle mesh model entirely specified by connected vertices and orientations of the vertices.

4. The method of claim 1 further comprising:

registering a projector illuminating the 3D physical object with the 3D physical object.

5. The method of claim 1 further comprising:

editing view-independent texture and view-dependent material characteristics of the 3D graphics model to reflect the desired appearance.

6. The method of claim 1 wherein the editing is interactive by applying a hand-held virtual paint brush tool directly to the 3D physical object.

7. The method of claim 1 further comprising:

tracking locations of a moving user.

8. The method of claim 1 wherein the moving user is tracked with a stereo-sensor.

9. The method of claim 4 further comprising:

specifying separate transformation matrices for the projector and shading parameters that are dependent on the user location.

10. The method of claim 1 wherein the intensities are corrected using alpha-blending of a rendering engine.

11. The method of claim 1 wherein the 3D physical object includes an arbitrarily shaped surface oriented at various angles.

12. The method of claim 1 further comprising:

rendering the virtual 3D graphics model as a plurality of image in parallel considering the user location and the location of the virtual light;

correcting intensity values of each image according to the orientation of the surface of the object and the radiance at the surface; and

illuminating the 3D physical object with the corrected plurality of images in parallel to give the 3D physical object the desired appearance under the virtual light when viewed from multiple user location.

13. The method of claim 1 further comprising:

blending intensity values in the corrected plurality of images in regions of overlap.

14. The method of claim 1 further comprising:

rendering the virtual 3D graphics model as a plurality of serial image considering a plurality of user location and a plurality of locations of the virtual light;

correcting intensity values of each image according to the orientation of the surface of the object and the radiance at the surface; and

illuminating the 3D physical object serially with the corrected plurality of images give the 3D physical object the desired appearance under the virtual light when viewed from the plurality of user location.

15. The method of claim 1 wherein the desired appearance simulates a rotation of the 3D physical object.

16. The method of claim 4 wherein the projector is a steerable laser.

17. The method of claim 1 wherein the 3D physical object is illuminated with a digital projector.

18. A method for animating an 3D physical object, comprising:

acquiring a 3D graphics model of a 3D physical object;

approximately positioning a projector;

determining a pose of the projector with respect to the 3D physical object;

defining a user location;

editing the 3D graphics model to reflect a desired appearance of the 3D physical object;

modifying the edited 3D graphics model based on the user location;

rendering the modified 3D graphics model as an image based on the pose and user location;

correcting image intensities for surface orientation of the 3D physical object; and

projecting the corrected image on the 3D physical object.

19. The method of claim 18 wherein a plurality of images are projected on the 3D physical model; and further comprising;

concurrently projecting a plurality of images on the object while blending intensities if the plurality of images for overlap and occlusion.